Novel heterostructure nanosheet boosts efficiency of lean-electrolyte lithium batteries

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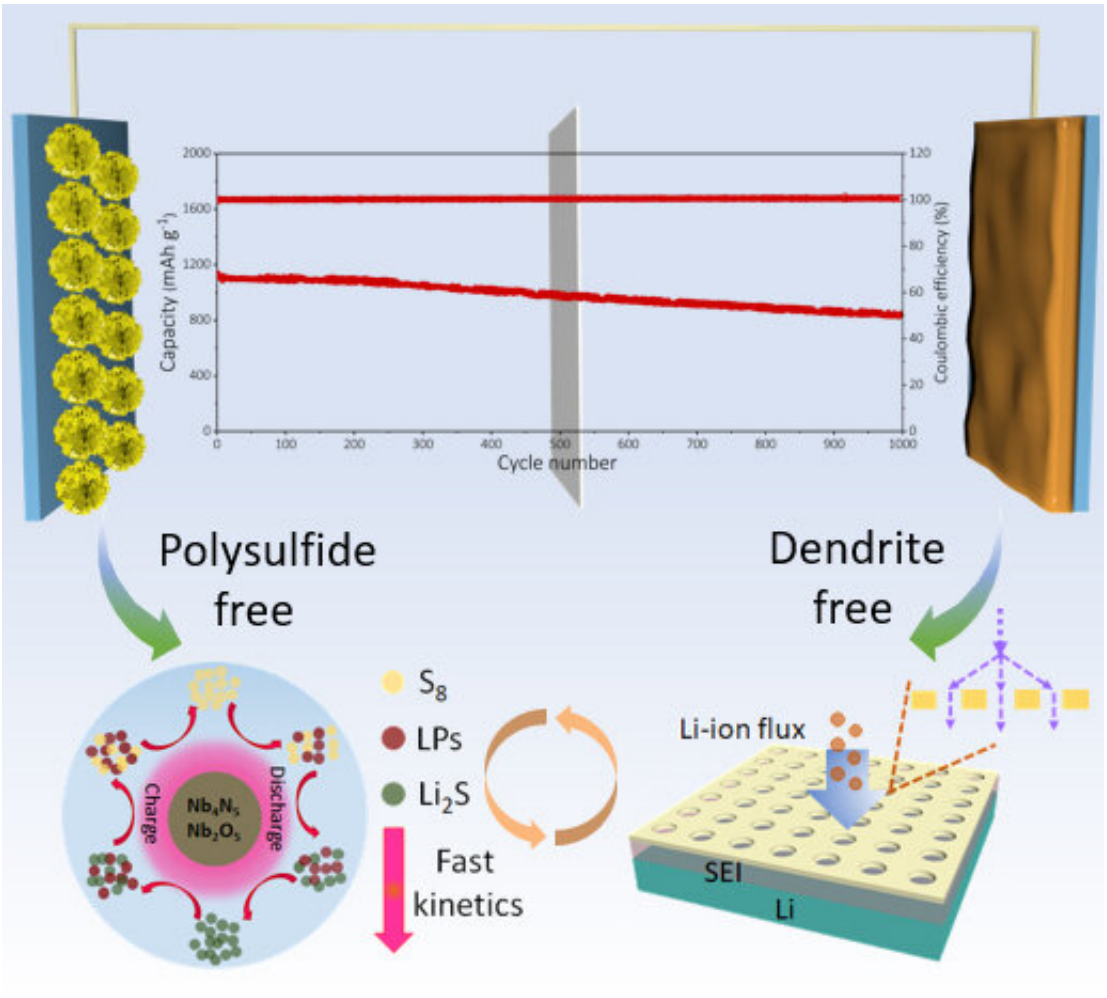

chematic of bifunctional niobium (V)-based heterostructure nanosheet toward high efficiency lean-electrolyte lithium-sulfur full batteries. Credit: SHI Haodong

Lithium sulfur (Li-S) battery technology is promising for next-generation energy storage. However, lithium polysulfide shuttling, sluggish redox kinetics, and uncontrollable lithium dendrite growth limit the cycling stability.

A research group led by Prof. Wu Zhongshuai from the Dalian Institute of Chemical Physics (DICP) of the Chinese Academy of Sciences developed niobium (V)-based heterostructure nanosheet for polysulfides-suppressed sulfur cathodes and dendrite-free lithium anodes in long-cycling and lean-electrolyte Li-S batteries.

This study was published in *Advanced Functional Materials*.

"We developed a twinborn holey Nb_4N_5-Nb_2O_5 heterostructure, serving as dual-functional host for both redox-kinetics-accelerated sulfur cathode and dendrite-inhibited lithium anode simultaneously," said Prof. Wu.

Polysulfide-shutting was alleviated due to the accelerative polysulfides anchoring-diffusion-converting efficiency of Nb_4N_5-Nb_2O_5. Meanwhile, the researchers applied lithiophilic nature of holey Nb_4N_5-Nb_2O_5 as an ion-redistributor for homogeneous Li-ion deposition.

The Li-S full battery presented a high areal capacity of 5.0 mAh cm^{-2} at sulfur loading of 6.9 mg cm^{-2}, corresponding to negative to positive capacity ratio of 2.4:1 and electrolyte to sulfur ratio of 5.1 μL mg^{-1}.

This work paves a new avenue for boosting high-performance Li-S batteries toward practical applications.

More information: Haodong Shi et al, Interfacial Engineering of Bifunctional Niobium (V)-Based Heterostructure Nanosheet Toward High Efficiency Lean-Electrolyte Lithium–Sulfur Full Batteries,

Advanced Functional Materials (2021). DOI: 10.1002/adfm.202102314